

MODEL JC213 - PURE POLYETHYLENE

Description:

Pure polyethylene from John Caunt Scientific is often used as a moderator to slow fast neutrons to thermal energies. To be most effective in these applications it is important to maximise the hydrogen content and minimise impurities that might absorb neutrons. High purity, high density, high and ultra high molecular weight polyethylene is readily available from John Caunt Scientific.

Chemical & Physical Properties:

Hydrogen: 14.28%

Density: 0.92g/cc

Options:

- Available machined into complex shapes
- Cut to customer requirements
- It is also available in bricks, rods and pellets.

Uses:

- Reactor physics
 - Around isotopic neutron sources
 - To protect instrumentation from fast neutrons
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MODEL JC201 - 5% BORON POLYETHYLENE

Description:

The combination of polyethylene with its high hydrogen content and boron, makes JC201 a very useful shielding material in areas of low and intermediate neutron flux. The boron content attenuates thermal neutrons and reduces the level of capture gamma rays, while the high hydrogen content thermalises fast neutrons.

JC201 is a light weight material that can be machined and shaped with standard tools or supplied cast to specification

Chemical & Physical Properties:

Hydrogen atoms/cc: 6.6×10^{22}

Boron atoms/cc: 2.6×10^{21}

Temperature limit: 82°C

Density: 0.95g/cc

Hydrogen: 96% that of water

Options:

- Available as slabs, bricks, rods and pellets.
- Other dimensions / shapes on request.
- Can be supplied machined to close tolerances.
- Other boron loadings available on request.
- Self extinguishing version available (see model JC207).

Uses:

- Shielding personnel
 - Neutron radiography
 - In hot cells and accelerators
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MODEL JC210 - 30% BORON POLYETHYLENE

Description:

In reactor fuel handling and reprocessing, control of criticality is of utmost importance. To ensure neutron isolation, materials containing very high boron concentrations are used.

Model JC210 is a polyethylene loaded with 30% natural boron, which is very effective in the capture of thermal neutrons.

Chemical & Physical Properties:

Hydrogen atoms/cc: 5.55×10^{22}

Boron atoms/cc: 18.7×10^{21}

Temperature limit: 82°C

Density: 1.19g/cc

Options:

- Available as slabs, bricks, rods and pellets.
- Can be pre-shaped to customer specifications.

Uses:

- Criticality control.

MODEL JC202 - LEAD LOADED BORATED POLYETHYLENE**Description:**

Lead Loaded Boron Polyethylene from JCS combines lead and boron in polyethylene providing an effective shield against mixed neutron / gamma fields. The hydrogen in polyethylene will thermalise fast neutrons. The boron captures thermal neutrons and suppresses capture gamma rays. The lead provides shielding against primary gamma rays.

Chemical & Physical Properties:

Boron Content: 1%

Lead Content: 80%

Temperature limit: 82°C

Density: 4.2g/cc

Lead Equivalence: 37%

Lead Equivalent Thickness: 18.8mm

Options:

- Available as sheets, rods or pellets.
- Other sizes and shapes can be made to customer specification.
- Other lead and boron loadings available on request.

MODEL JC215 - LITHIUM-POLYETHYLENE**Description:**

Gamma sensitive radiation detectors used near neutron sources need shielding from both capture gamma-rays and the neutron source. A borated polyethylene will attenuate the neutron flux but results in a 0.42MeV capture gamma-ray. Lithium Polyethylene does not produce capture gamma-rays and is therefore ideal for this application.

Chemical & Physical Properties:

Hydrogen atoms/cc: 5.44×10^{22}

Lithium atoms/cc: 6.7×10^{21}

Temperature limit: 82°C

Density: 1.06g/cc

Options:

- Shields using enriched lithium 6.
- Pre-cast shapes and sizes on request.
- Other lithium concentrations on request.

MODEL JC207 - SELF-EXTINGUISHING BORATED POLYETHYLENE

Description:

JC207 from John Caunt Scientific is a self-extinguishing borated polyethylene. Ideally suited for use as a shielding material in areas of low and intermediate neutron flux, where there is concern about the level of combustible materials.

Chemical & Physical Properties:

ASTM Test D-635: shows the material is self-extinguishing
ASTM Test D-2863: gives oxygen index of 30.2
Hydrogen content: 100% that of water
Hydrogen atoms/cc: 6.6×10^{22}
Boron atoms/cc: 0.54×10^{21}
Density: 1.4g/cc

Options:

- Available as sheets, rod, pellets or pre-cast to customer specification.

Uses:

- Power plants shielding hatches, ducts, sumps and stairwells..

MODEL JC227 - BORATED FLEX / PANEL WALL SHIELD**Description:**

High energy accelerators and fusion test facilities can produce high energy neutrons. JC227 is designed to be fixed to walls, floors and ceilings to reduce activation of concrete and cut down the overall radiation field. Borated Flex / Panel Wall Shield is a self-extinguishing, lightweight material with a high concentration of boron. The rubber-like material is easily handled and can be cut to size using a sharp knife.

Chemical & Physical Properties:

Sheet size: 1219 x 1219 x 7 mm thick
Weight: 12.3 kg per sheet
Hydrogen atoms/cc: 4.63×10^{22}
Boron atoms/cc: 5.8×10^{21}
Temperature limit: 82°C
Density: 1.16g/cc

Uses:

- Fixing to walls to minimise concrete activation.

MODEL JC238 - FLEX BORON SHEET**Description:**

This is a fire resistant silicon based elastomer containing a high weight percentage of boron. Model JC238 is used to attenuate thermal neutrons around irregular shapes. It is extremely flexible and can be bent to a radius of 6.4mm.

Chemical & Physical Properties:

Hydrogen atoms/cc: 2.7×10^{22}
Boron atoms/cc: 23.2×10^{21}
Temperature limit: 205°C
Density: 1.64g/cc

Options:

- Standard sheets: 305 x 610 x 3.2 mm thick
610 x 914 x 3.2 mm thick
- Other sizes and thicknesses available on request.

Uses:

- Where a flexible protection against thermal neutrons is required.

MODEL JC259 - POLYCAST

Description:

Polycast is a dry mix material designed to be cast into closed containers. It is field castable, providing excellent, low cost neutron shielding, with a hydrogen content 6% greater than that of water. JC259 has 0.9% boron present to suppress radiation from capture gamma rays.

Polycast is mixed with water, it forms a strong solid material 30 minutes after casting and can be poured in layers as each layer bonds to the previous one.

Chemical & Physical Properties:

Hydrogen atoms/cc: 7.10×10^{22}

Boron atoms/cc: 0.58×10^{21}

Temperature limit: 66°C

Density: 1.15g/cc

Features:

- Field castable without special tools.
- Only requires water for mixing.

Uses:

- Walls.
 - Roof slabs for cyclotron facility.
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MODEL JC277 - HEAT RESISTANT SHIELDING

Description:

High temperature resistance is often required for reactor shielding. Model JC277 is designed to retain significant shielding properties up to 230°C, and maintains physical integrity to 1038°C. JC277 is a rugged material which can be shaped with standard power tools. It is completely non-combustible and field castable. With three times as much hydrogen as concrete it is well suited to attenuate the neutron flux from reactors.

Chemical & Physical Properties:

Hydrogen atoms/cc: 3.4×10^{22}

Boron atoms/cc: 1.43×10^{21}

Density: 1.68g/cc

Compressive Strength: 1000psi

Options:

- Available as dry mix for casting.
- Can be pre-cast to customer specification.

Uses:

- Penetration seal in reactor dry well.
 - Cast into doors around primary coolant piping.
 - Reduction of neutron background.
 - Sacrificial shield wall.
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MODEL JC237 - BORO-SILICONE

Description:

Boro-silicone is a fire resistant, heat resistant, self-extinguishing elastomer which is available for field casting or pre-cast to specification. It is hydrogen rich and will withstand temperatures of up to 205°C for long periods while retaining most shielding properties. It has 1% added boron to give enhanced thermal neutron capture.

Chemical & Physical Properties:

Hydrogen atoms/cc: 4.49×10^{22}
Boron atoms/cc: 0.94×10^{21}
Density: 1.59g/cc

Options:

- Other boron concentrations available on request.
- Varied shapes and sizes, including pre-cast pieces to individual designs.

Uses:

- Reactor cavity neutron shielding plug.
 - Biological neutron shield for coolant re-circulating lines.
 - In-core instrumentation shield.
 - Reactor fuel transport flasks.
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MODEL JC243 - NEUTRON ISOLATOR**Description:**

Model JC243 is a resin based material with a glossy surface for easy decontamination. It will withstand temperatures of up to 177°C and is self-extinguishing. JC243 is supplied in pre-cast shapes, which makes it ideal shielding material for areas where it is not necessary, or desirable, to contain the material in stainless steel.

Chemical & Physical Properties:

Hydrogen atoms/cc: 5.03×10^{22}
Boron atoms/cc: 2.88×10^{21}
Temperature limit: 177°C
Density: 1.55g/cc

MODEL JC244 - NEUTRON ISOLATOR**Description:**

Model JC244 is a field-castable, non-combustible material designed to be cast by the addition of water into stainless steel or other protective enclosures. JC244 will maintain 50% of its hydrogen at 177°C. The material is mixed in an ordinary cement mixer with the addition of water and does not require heating.

Chemical & Physical Properties:

Hydrogen atoms/cc: 4.5×10^{22}
Boron atoms/cc: 2.88×10^{21}
Temperature limit: 177°C
Density of Cast Material: 1.8g/cc

MODEL JC291 - BORAL**Description:**

Boral is a uniform dispersion of a boron carbide in aluminium. The resulting sandwich has an exceptionally high cross-section for thermal neutrons and will withstand temperatures up to 540°C.

Chemical & Physical Properties:

Boron atoms/cc: 23.8×10^{21}
Temperature Limit: 540°C
Density: 2.5g/cc

Options:

- Available cut to size.

- Fabricated to customer shape.

Uses:

- Isolators in spent fuel element racks.
- Inner sections of reactor shields.
- Neutron curtains.
- Shipping containers.

MODEL JC258 - NEUTRON SHIPPING CASKS**Description:**

Neutron sources such as Cf, Am-Be and Pu-Be require transporting in specialist shielding casks. Model JC258 is designed for this purpose. These casks are designed to be moved by fork lift or overhead lifting device.

The casks are ruggedly constructed of heavy gauge steel, using Polycast JC259 as the shielding material, which has an exceptionally high hydrogen content. There is a central lead cup to shield against primary gammas and 0.9% boron to absorb thermal neutrons and suppress secondary gamma dose. The casks can be qualified as DOT Type 'A' shipping containers.

Dimensions:

Cat No.	CASK		Maximum Source Size for		
			Shipping*		Storage**
	Diameter (mm)	Weight (kg)	Cf-252 μg	Am-Be or Pu-Be Ci	Cf-252 μg
258 D	457	125	30	13	0.4
258 E	572	225	75	20	3
258 F	686	320	150	N/A	3
258 G	838	615	375	N/A	9
258 H	1016	1360	1000	N/A	32
258 I	1219	2270	2500	N/A	100

* Shipping limit is based on 10 mR/h at 1m or 200 mR/h at cask surface, whichever is reached first.

** Based on 2.5 mR/h at cask surface.

Uses:

- Transport of neutron sources.

MODEL JC261 - NEUTRON PUTTY**Description:**

Neutron putty is non-hardening boron loaded putty with a high hydrogen content. A 25mm thickness of JC261 will attenuate thermal neutrons by a factor of approximately 10^5 .

Chemical & Physical Properties:

Hydrogen content: 8.94%

Boron content: 10%

Temperature Limit: 45°C

Density: 1.1g/cc

Neutron putty is available in 3.6kg cans.

Uses:

- Temporary neutron shielding.

- Collimation of neutrons.
 - Blocking neutron streams.
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MODEL JC240 - CADMIUM SHEET

Description:

Cadmium sheet is often used for attenuation of thermal neutrons and, because of its high cross section, it is effective even as thin sheets.

MODEL JC241 - BORON CARBIDE POWDER

Description:

Boron carbide powder is available in fine powder with 68.3% boron content. Bulk density after vibration is 52% of solid density.

MODEL JC001 - BORATED WAX

Description:

Model JC001 is a wax with a 5% boron loading, often used for low cost neutron shielding when lining doors or filling wells. Borated wax has a density of 0.9 g cm^{-3} and a softening point of 70°C .

Options:

- Other boron concentrations on request.